

Feasibility Study on the Development of Functional Food Products from Local Crops in Malaysia

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Abstract—Consumer choice and preferences are the utmost criteria when selecting which product needs to be formulated. Awareness of healthier choices leads to consumer demand for functional food that consists of nutritional properties and provide beneficial health attributes. Products added with useful ingredients are functional food. Therefore, the aim of this study was to explore and understand the consumption pattern of functional food among Malaysian consumers by conducting a survey. This offers a new basis to understand how Malaysian consumers from various religion and race choose functional foods in this era, especially after the pandemic has ended. A total of 102 respondents participated that consisted of Malaysian adults aged from 18 to late 60s regardless of the household incomes from all over states in Malaysia. This study indicated that 96.9 percent of respondents are knowledgeable about the idea and benefits of functional foods. A total of 23.5% of respondents consumed it every day, and 27% purchased it on a regular basis, usually purchased from supermarkets and hypermarkets. Innovation ideas were given from selected 31 local crops in Malaysia such as juice products, cordials, healthy bars, ice creams, freeze dried snacks, multi-purpose powder etc. According to the results, there is a potential market and buyers for functional foods produced locally. This survey provides a strong suggestion to food industries to start off with functional food products added with local food ingredients.

Keywords—Functional food; food product; transmission line; consumer.

Manuscript received 7 Sep. 2023; revised 7 Nov. 2023; accepted 9 May 2024. Date of publication 30 Jun. 2024.
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I. INTRODUCTION

Recently, the development of functional foods is moving in a fast pace around the world [1]–[6]. Covid-19 pandemic changed the lifestyle of Malaysia consumers [7]. However, [8] identified four major trends and concerns for functional foods in Malaysia. Functional food products are usually fortified or added with valuable ingredients to provide more than essential nutrition to consumers. Firstly, by gender differences, 114 Malaysian women are accepting more functional food products compared to 86 men, according to a survey of Malay Muslim consumers [9]. Weight loss is the primary motivator for functional foods, but health issues continue to grow. It has been shown that low carotenoid intake leads to diseases [10]. Women with children primarily

consume and prepare healthy meals [11]. Healthy food intake among Malaysian school children can be improved by placing healthy food options in the school canteen [12], [13] 86 Malaysian schoolchildren aged 10-11 participated in a healthy meal preparation intervention, significantly reducing unhealthy food consumption [13].

Secondly, it is a product trend. Sales trend and expenditure also influences a product boost among consumers [14]. Malaysian functional foods are classified into two categories. First, increased nutrients amount to naturally occurring nutrients in foods. These include fibre-enriched cookies and cereals. The second trend is foods with added nutrients. This includes omega-3-fortified meals and drinks, noodles, and "healthy snacks" like chips and crackers fortified with calcium or iron. Food made using carefully selected

II. MATERIALS AND METHOD

ingredients is supplied. Similarly, foods that boost a specific health advantage from their carefully curated ingredient lists are included. For example, margarine and milk have been added with plant-based sterols to lower cholesterol among consumers.

Thirdly, supply trends. The supply and availability of functional foods varies in small and large shops. Isotonic beverages, energy drinks, and cultured milk drinks are sold at street-side booths and hypermarkets. Functional foods are usually placed next to conventional products on the shelves, thus reducing consumer perception regarding the potential health benefits. More giant hypermarkets and supermarkets are introducing organic product aisles, which allows functional foods to stand out. Moreover, Malaysians love eating out. About 64% of Malaysians consume no less than one meal from eatery options daily, and 36% dine at home at least once a week. As consumer health consciousness rises, demand for healthier food service options will increase [8]. Meanwhile, mobile diet applications can be used to monitor healthy eating habits and positive health impacts among Malaysian adults [15].

Lastly, Malaysia's functional food rules are strict. However, current food regulations allow claims for bioactive components; authorities use a "positive list" method to limit food items to those on the list. A 'positive list' approach by the Food Safety and Quality Division (FSQD), Ministry of Health Malaysia consists of claims listed on Reg. 18E (4) are permitted, there are 52 functional claims permitted, with 23 function claims for "classical nutrients" (i.e., protein, vitamins and minerals) and 29 other function claims for "other food components" (i.e., beta-glucan, plant sterol etc.).

Usually, functional claims for a typical food product may differ depending on its target. For example, it can be claimed to reduce cholesterol levels, produce a good gut environment, raise bifidobacterial levels in the gastrointestinal tract, strengthen babies' immune systems, and help for better visual context. Functional claims for oats beta-glucan are from the "positive list" (which is used to lower cholesterol levels), and calcium is allowed. In Malaysia, claims on specific ingredients in alleviating diseases are not allowed. The food sector is making headway in applying for new functional claims through the Food Safety and Quality Division, Health Ministry, although Malaysian regulations are an obstacle for the functional food market [16].

Previously, research on malnutrition among senior citizens in Malaysia has been reported [17]. Similarly, the intention of older people to consume functional is increasing around the world [18], [19]. Marketers should also educate the older adult population about functional foods, which have been scientifically proven to deliver their advertised benefits and can provide assurance for their health.

Based on the status of consumer needs for functional food, increased functional food product trends in the market, and recent supply trends, functional food products can be obtained easily. However, there is limited utilization of incorporating local crops into functional food products, although they are available in abundance. Hence, this study aimed to survey and explore the feasibility of developing new innovative food products from local crops planted on under-utilized land in Selangor, Malaysia.

The main aim of this survey is to explore the knowledge, purchasing power, and eating frequencies of functional food models in the Malaysian market. This presents a new background for understanding how Malaysian consumers, regardless of logistics, age, race, and religion, choose their functional food in the current era, especially after the pandemic. This survey gathers ideas regarding potential functional food that consumers yearned for.

A. Participants and Methodology

The sample size for this research was Malaysian adults aged 18 to late 60s regardless of the household incomes from all over the states in Malaysia. This broad age range was selected to gather knowledge from university/college students, working adults, and older generations, whose consumer demand varies depending on age. Functional food is usually an easy option for busy individuals. An online sampling method through a survey was used, and the questionnaire was circulated to all participants who understood the aim of this research. Structured questions were used to develop the consumption pattern of functional food models for Malaysians. The Malay language was used in this questionnaire as it is the national and prime language among multiracial Malaysians. Participants who had trouble understanding were helped and guided one-to-one to complete the survey. Participants pre-tested the questionnaire to determine its accessibility before it was distributed. In total, 102 respondents took part in this study.

The questionnaire used in this study was divided into three sections, starting with socio-demographic variables, then information about functional food, perception and purchasing power regarding functional food, and thirdly, the idea and opinion of participants regarding potential functional food products from local crops planted on under-utilized land in Selangor. The questionnaire was circulated among participants and self-administered through an online platform, Google Forms. This questionnaire link was distributed through social media platforms like Facebook, WhatsApp, Twitter, Instagram, and Google Mail. The standard socio-demographic information includes age, gender, educational background, career information, and household revenue. Information on purchasing power was obtained using dichotomous, open-ended, and multiple-choice questions.

Participants regarded their behavior on purchasing power and information of functional food characteristics on five-point Likert-type scales, where 1 was explained as a completely unimportant point, and 5 denoted a very significant value. Participants should also rate their views on two statements about functional foods on a scale that ranged from (1)—totally disagree to (5)—totally agree. There were no exclusion criteria from the respondents list, as all answers were accepted equally. The questionnaire was sent to those with internet access; those with limited access were not included in this study.

B. Statistical Analysis

The results were reported as mean value \pm standard deviations, and the obtained data were statistically analyzed

using one-way analysis of variance (ANOVA) by using the Statistical Package for Social Sciences (SPSS) software. Differences between means at 5% ($p < 0.05$) were considered significant.

III. RESULTS AND DISCUSSION

A. Demographic

The findings from the feasibility study consisted of information obtained from 102 respondents with stable

internet connections. Fig. 1 displays the demographic data for the research divided down by gender. There are 97 respondents in the group. 68 percent of the respondents were female, while only 32 percent were male. The demographic characteristics of the research by age are shown in Fig. 1; 32.7% of survey respondents between the ages of 30 and 39 completed the form; the lowest number was 10.2%. 25.5% of the population was between 40 and 49, and 31.6% was between 20 and 29 years old.

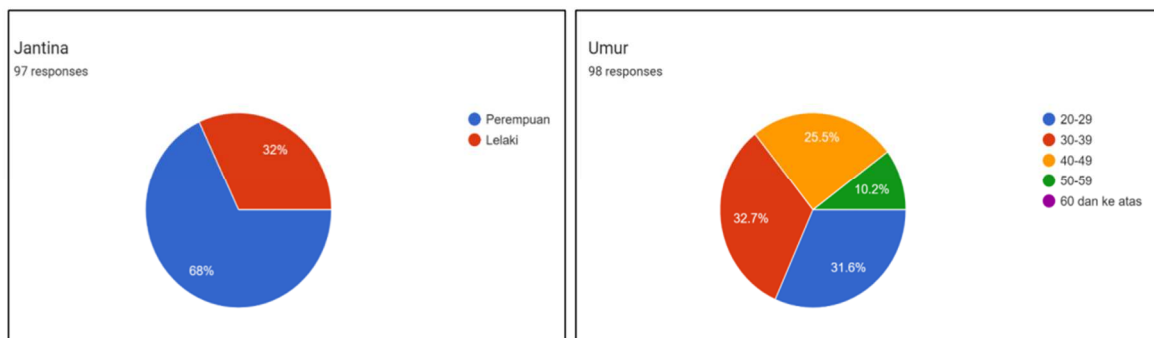


Fig. 1 Pie Chart Percentage of Gender and Age of Respondents

Next, respondents were questioned about their employment situation, including whether they were self-employed, employed by the government or privately, retired, in school, or not employed (see Fig. 2). According to the survey, 26.8% of respondents work for private firms. In comparison, 33.0% are employed by the government. However, only 2.1% of respondents were unemployed, and 20.6% of respondents were students. The respondents' educational categories are then depicted in Fig. 2, ranging from SPM, diploma, Ijazah Muda, Ijazah Sarjana, PhD, and Ijazah Sarjana Muda. According to the survey, Ijazah Muda and Ijazah Sarjana have the greatest response rate, at 31.6%. One percent of

respondents (the lowest number) have a degree. However, the percentages of respondents with a diploma and a PhD are 17.6% and 10.2%, respectively. Only 8.2% of those surveyed had SPM qualifications. Respondents were questioned regarding their household's monthly revenue (refer to Fig. 2). There are four choices for the optional responses, with the lowest being RM2,500 and the highest being RM10,971 or more. Many of the respondents made between RM4851 and RM10970 per month. 24% of respondents make between RM2500 and RM4850, with 22.9% of respondents making less than RM2500. Only 12.5% of respondents reported having a family income of at least RM10,000.



Fig. 2 Pie Chart Percentage of Job Categories, Education Levels and Household's Monthly Revenue of Respondents

B. Knowing the Knowledge of Functional Foods

By knowing the respondents' functional food knowledge, respondents were asked questions about their opinions about the advantages of functional food products. Even as functional food does not have a specific meaning, it can be summed up as any raw or minimally processed food that is said to have health beneficial or beyond the fundamental dietary purpose of supplying nutrients, a disease-preventing quality [20], [21] Respondents acknowledged that functional food is a food supplement that offers the body adequate nutrition. They also thought that functional food has various advantages, including boosting immunity, providing vitality, and enhancing general health. Not to mention that functional food is simpler to use and keep.

Fig. 3 displays the respondents' viewpoints on Malaysia's functional food trend. In Malaysia, the tendency towards functional foods is rising, according to more than half of respondents (60.8%), with 4.1% of those polled believing the opposite. 13.4% of respondents believe this tendency is stable, while the remaining 21.6% are unsure. Innovations in the food industry frequently focus on creating essential replacement products, following dietary guidelines, or obeying laws regulating food additives. They can be focused on one area of food technology, such as process engineering, product formulation, food qualities, or consumer requirements. In general, they are new or improved consumer goods and services. To create food that meets the social, personal, and nutritional requirements of all communities, they must also combine technological innovation with social

and cultural innovation [22]. The number of respondents who have tried functional food was determined. Based on Fig. 3, 96.9% of respondents have tried functional foods, and another

3.1% have never tried eating functional foods. Therefore, it's worth noting that all respondents were aware of the meaning of functional foods.



Fig. 3 Pie Chart Percentage of Respondents' Opinion of Trend Functional and Percentage of Respondents Have Tried Functional Food in Malaysia

C. Attitude Toward Functional Food

Next, Fig. 4 shows that 38.8% of respondents reported that they often consumed functional food every week. Also, 23.5% of respondents consumed it daily and twice monthly at 20.4 percent. The frequency of respondents taking functional food once a month is 14.3%, and 3.1% of respondents never take it in their meals. This is because some individuals may not have a strong knowledge of this functional food product.

Based on Fig. 4 below, the choice of any time is the highest time respondents use to consume functional food, which is 51.5%. Next, 28.9% of respondents used it at breakfast and 9.3% at lunchtime. Respondents who never take functional food at night are 7.2% and 3.1%, respectively. There was also a question on whether the respondents have eaten functional food products or known by the respondents. Based on this question, it is obvious that various functional foods are

already on the market and known to the public. Before choosing to purchase a product, customers weigh the dangers involved. multiple factors are referred to as perceived or anticipated risks. Consumers cannot immediately return products to retail stores, increasing cognitive experience risk. The trend towards online shopping, meanwhile, is expanding the reduced perceived risk consumers discover [23].

However, functional foods in the Malaysian market are increasing with public health care awareness. Furthermore, a healthy eating index has been improvised for the Malaysian population to ensure consumption pattern has a balanced diet [24] Fig. 4 shows that more than half (58.8%) of respondents often find functional food products in supermarkets such as Lotus, Giant, Jaya Grocer, and Lulu hypermarkets. Purchases at local stores such as grocery stores, health food stores, and online stores were 23.7% and 14.4%, respectively. Only 3.1% of respondents have never bought any functional food.



Fig. 4 Pie Chart Percentage of Frequency of Respondents Taking Functional Food, Respondents Take Functional Food and Percentage of Place Can Get Functional Food Product

Furthermore, Fig. 5 shows the highest reason respondents choose to consume functional food products is that 70.1% believe functional food can increase energy and endurance. Functional food can maintain health and improve the immune system, and improving the daily nutritional diet is the second and third highest reason, with 57.7% and 51.5% of respondents choosing to consume functional food. 34 respondents (35.1%) chose functional food because it is easy, economical, and suitable for consumption at any time; 29 respondents took functional food for medical purposes, and to enjoy the product itself was the reason 26 respondents took functional food. For losing weight, increasing muscle mass

and being suggested by a friend led to 19.6%, 12.4%, and 7.2% of respondents choosing to take functional food. Only 3.1% of respondents never consume functional food.

In addition, Fig. 5 shows that 72.9% have never been diagnosed with a disease/food allergy by a valid medical doctor, and 27.1% have a disease or are allergic to certain foods. It was found that allergies to gluten and seafood are among the illnesses that respondents have. Additionally, some individuals have irritable bowel syndrome, Systemic Lupus Erythematosus (SLE), H pylori bacteria in their intestines, eczema, and diabetes.



Fig. 5 Pie Chart Percentage of Reason Respondents Consume Functional Food and Respondents Been Diagnosed with a Disease / Food Allergy

D. Future Goals of Functional Food Purchasing Power

Respondents were asked about their willingness to spend money on functional food for a month (refer to Fig. 6). There are 5 optional answers ranging from RM0 to the highest spending of more than RM200. Most respondents were willing to spend RM100 to buy functional food (33%). Meanwhile, 26.6% would spend RM50 or less for others, and 23.4% of respondents are pleased to spend RM200 on functional food products. Only 13.8% of respondents wished to pay more than RM200 for functional food, and 3.2% decided not to allocate any functional food in the future.



Fig. 6 Pie Chart of Percentage of Willingness of Spending Towards Functional Food Products and Percentage of Degree of Agreement Towards Branding Influences Respondents' Functional Foods Choice Behavior.

Then, continuing to observe the pattern of respondents' buying intention regarding functional food products, they were asked whether the nutritional information on food labeling also influences their purchasing choices. As the pandemic reached, Malaysians considered shifting their diet to healthy and nutritious [7]. This question was raised to support this belief. 44.9% of respondents agreed that purchasing action was influenced by the nutritional facts on food products (refer to Fig. 7). 42.9% agreed with this statement, while 10.2% voted neutral. The other 1% disagreed, and 1% highly disagreed with this statement.

The convincing vote regarding the brands has influenced their action into purchasing functional food products; hence, it makes sense that most of the respondents may be influenced by social media advertisement, with 34.7% of them choosing social media like Facebook, Twitter, TikTok & Instagram are the most online platform show advertised about functional food. Studies have shown social media is indeed an effective online communication tool that has made a significant impact on society [26]. Even more, another study had shown product recommendations from social media influencers received a

A vital brand status lays a groundwork of trust between marketers and consumers [25]. From this basis, it can be expected that it will influence the purchasing behavior of consumers. Based on the survey conducted, 39.8% of the respondents agreed with this statement about buying functional food products, whereas 24.5% highly agreed that branding influences them in choosing functional food products (refer to Fig. 6). However, 28.6% of respondents chose to be neutral in this statement. Others disagreed with this averment – 5.1% disagreed, and 2% highly disagreed.

higher trust rate compared to products recommended by families or friends, resulting in 40% of consumers purchasing the products used by social media influencers [27]. Brand awareness is essential to introduce functional food products to consumers. 17.3% of respondents also voted that reading nutritional facts or nutritional claims on the labeling gives them knowledge of functional food products. Counseling advice from nutritionists, dietitians, and doctors and reading from website portals shared the same amount of voting from respondents, which is 16.3%, where third and fourth popular sources of knowledge of functional food respondents were getting from. The least respondents get an understanding of functional foods from conventional mediums like advertisements through magazines, television, billboards, and close friends or mutuals (refer to Fig. 7). Research from [28] showed that traditional marketing media such as televisions, magazines, and radios were currently unstable and ineffective due to the internet's change in the market. Through this survey, we can assume that the fewest respondents may be influenced to know about functional food products through these conventional mediums.

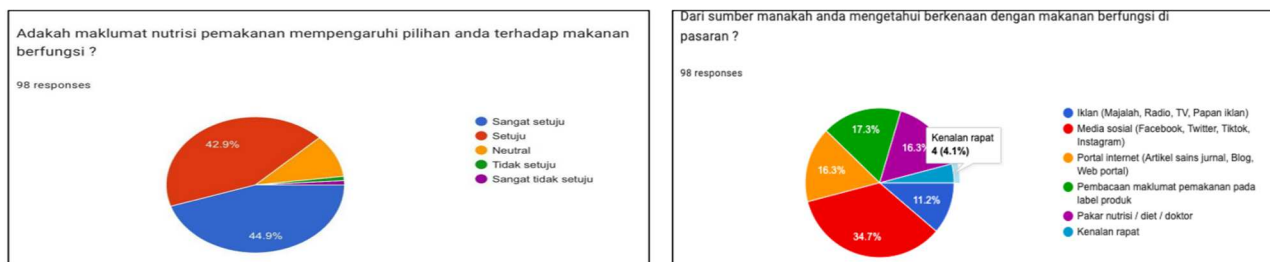


Fig. 7 Pie Chart of Percentage of Degree of Agreement Towards Nutritional Facts Influences Respondents' Functional Foods Choice Behavior and Percentage of Sources of Information the Respondents Obtained Regarding the Functional Food Terms in the Available Market

E. Opinion on Functional Food Products from Local Crops

This survey asked respondents to give their opinions and ideas on innovating functional food products from 31 local crops. Popular innovation ideas given by respondents are juice products, cordials, healthy bars, ice creams, beneficial extraction, freeze-dried snacks, multi-purpose powder form for easier cooking, cereals, and many more. The opinions are primarily about convenient products to store and cook, especially for working mothers and housewives; respondents also suggest less processed products, like dried fruits and vegetables. It is a lightweight, nutrient-dense option, rather than regular chips and snacks in high-sodium markets.

This process preserves food for much longer than its ordinary shelf life. Hence, it is convenient for housewives and people with busy lifestyles. Dehydrated foods can also be a healthier alternative to many snacks, as they can be added to salads, oatmeal, baked goods, and smoothies or eaten on the go. It has been mentioned that the top 10 functional food trends that are influencing U.S consumer behavior in 2022 are having functional cooking values [29]. Dehydrated fruits and vegetables and natural sources of coloring and flavor are most recommended by respondents for product development. Since the pandemic began, people cooking more of their meals at home, products, ingredients, and recipes that make healthy food preparation easier are in demand [7].

It has been reported that 7 in 10 Malaysians want to eat healthier, and 44% are willing to spend extra. Additionally, there were three times as many orders for healthy food in 2020 as there were in 2019 [30]. Moreover, fresh fruit and vegetable mixed juices were popular among respondents, as they are believed to be well known for their immunity boosters, improved gut health, good antioxidants, and low calories. Respondents also suggested plant-based alternatives using local crops, especially butter and milk. Respondents suggested ice cream, gummies, jams, and many other foods considered unhealthy or high in calories. Some may believe the local market needs to produce more healthy and functional values added in junk foods on par with overseas brands that suit the local taste and are pocket-friendly.

IV. CONCLUSION

According to the study's findings, 96.9% of respondents know the idea and benefits of functional foods. A total of 23.5% of respondents consume it every day, and 27% buy it consistently. Functional foods are usually purchased from supermarkets. According to this survey, there is a potential market and buyers for functional food products by local crops. This survey suggests that producers start with food products common with local food trends, consumption, convenience,

and functionality. Similarly, local crop cultivation on under-utilized land can also meet the increased consumer demand in Malaysia while helping food manufacturers turn it into functional food. It is a challenge for food manufacturers to innovate functional food products that highlight the unique selling proposition of sugar-free, fat-free, low sodium, high fiber, and high protein using local crops. This effort needs helix collaboration between food manufacturers, academicians, and government agencies related to agriculture. It's a huge opportunity to explore as functional foods are showing an increasing trend and are expected to grow over the years continually.

ACKNOWLEDGEMENT

The authors thank UiTM and the laboratory staff for the facilities and technical assistance. They would also like to thank Business Ventures, Land Administration, and Land Planning of TNB Grid Division, the Board Technical Committee, and project team members from TNB Research Sdn. Bhd. for continuous support in this research area.

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